31 January 1964

MEMORANDUM FOR THE RECORD

1. SUBJECT: PAR #216, Contract [redacted] "Exposure of Photographic Materials with Lasers" 25X1

2. REFERENCES:
a. [redacted] Quarterly Report, Contract [redacted] Second Quarter, FY 64. 25X1 25X1

b. Memorandum for Assistant for Administration re Authorization to Proceed, Contract [redacted] PAR #216, dated 31 January 1964. 25X1

c. Memorandum for the Record, re "Optimization of the Laser", dated 29 January 1964.

d. Conference at P&DS, 12 December 1963.

e. Conference at P&DS, 23 January 1964.

3. ACTION REQUIRED: Contractor should be instructed to proceed with research as proposed in the Study Objectives for PAR #216 with the exception of item B, "Optimization of the Laser", which should be considered as a separate project.

4. ACTION TAKEN:
a. Reference 2b has been drafted to initiate action instructions to the contractor through appropriate channels.

b. Reference 2c was written to confirm the basic objectives of the Laser Optimization research.

5. COORDINATION: The above actions are consistent with verbal instructions given to [redacted] on 12 December and 23 January, references 2c and 2d. 25X1

6. COPIES FURNISHED: [redacted]

Development Branch, P&DS

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RESEARCH OBJECTIVES FOR A STUDY ON THE EFFECTS OF EXPOSING PHOTOGRAPHIC MATERIALS WITH LASERS

I. Study Concepts

Lasers produce ultra-high intensity, very narrow angle beams of coherent monochromatic light. Because of these unique characteristics, the laser theoretically appears ideally adapted for applications in the field of photography.

Lasers also have serious limitations. One of these is that, unfortunately, commercially available lasers operate from just inside the visible red range far down into the infrared regions of the spectrum.

Tremendous amounts of research moneys have and are being expended on a search for materials that will lase in the shorter wave lengths of both visible and ultra-violet light. However, a major breakthrough is required to bring this to fruition and for the present, as far as photographic requirements are concerned, it will be necessary to work with the red and the near infrared.

Considerable research has been accomplished on the response of black and white films to the red and near infrared light and yet there are still many areas in which adequate information is totally lacking.

An additional problem area results from the fact that truly coherent light sources tend to produce interference phenomena. More research is required in this field. It becomes obvious that if lasers are going to be used in the photographic process, knowledge in these areas must be expended. A comprehensive timely study of the effects and ramifications of exposing photography using a laser as a light source is required. This study should cover the problem areas related to both photographic materials and photographic techniques.

These research objectives define the research areas of primary interest, the specific requirements to be met and the specific questions to be answered by this study.

II. Study Areas and Specific Requirements

A. Film Response and Resolution

This study must result in the determination of the manner and the degree to which present and predictable future high resolution films are responsive to light energy in the red and near infrared ranges. Particular attention should be given to the red spectrum close of 6328 angstron units.

The following specific determinations must be made:

1. Do films exposed with light energy in the red and infrared ranges exhibit the same basic known resolution characteristics they exhibited when exposed with actinic light of shorter wave length?

2. Should research indicate that present standard films either do not respond well or maintain their high resolution characteristics, what films should be utilized? Are the required films currently available or must they be developed? If a development proves necessary, what would be the extent, predicted cost and the time required for such a program?

3. The use of highly coherent light may produce an acute problem because of resulting interference phenomena. Specifically, the study must determine the effects upon resolution of the interference phenomena resulting from diffractions caused by using coherent light with a material with the turbid nature of a silver halide emulsion. These effects must be studied both when the light is transmitted through the film and when it is incident upon it.

B. Optimization of the Laser

Most current photographic applications have used or propose the utilization of a continuous gas laser operating in the visible red. Additional information is required to facilitate determination of the type or types of lasers best adapted for installation in present and future equipment.

1. Research is required to determine if there is a specific wave length/frequency band or range in the red or near infrared that will prove optimum for the exposure of photography. If such a frequency band or range exists, are there commercially available units that lase in this region?

2. Do any of the newer lasers such as the Glass-Neodynium, Liquid-Nitrobenzene, Solid State Injection or Carborundum lasers hold significant promise for photographic use with present or predicted photographic materials?

C. Effects of Heat

Lasers produce considereble heat. It is doubtful that enough heat is generated by a gas laser over its brief exposure time to affect the film; however, heat effects should be either confirmed or obviated as a problem area.

Specifically, the following questions must be answered:

1. Do lasers in photographic applications produce enough heat to affect the image quality of the film or to change it dimensionally?

If there is a dimensional change what are its ramifications, with respect to the exposure process, and will the exposed film return to its previous dimensions? What will be the magnitude of these changes? Will exposure to different frequencies of light result in different magnitudes of changes?

2. Will exposure to laser illumination change the basic elasticity characteristics of the emulsion and/or base materials? If so, is this a reversible process? If not, how can we combat it? How do these effects vary with changes in the frequency factors of the spectrum to which they were exposed?

3. Will film which has been exposed by laser illumination deteriorate faster with age than film exposed by more ordinary methods?

D. Photographic Processing

Will exposure of films by lasers result in any necessary changes to standard photographic processing techniques? If such changes are necessary, in what specific areas will they be required? Are the necessary techniques known and is the prerequisite equipment available to accommodate these changes?

III. General Requirements

This study is intended not only to provide information and to answer specific questions on problems and problem areas which have been defined by the requestor but, in addition, it is intended to promote interest in and thinking on possible related problems which have not been defined or envisioned. In all cases, information shall be obtained for both the films currently in use and those experimental films presently under study for contemplated use in the near future.